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The essay examines U.S. dependence on South Africa as a supplier of strategic raw materials and the impact of such a supply source on U.S. national defense production. The essay limits its strategic raw materials to manganese, chromium, and platinum. It also examines alternate sources of strategic materials and U.S. inhibitors to domestic production.

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US ARMY WAR COLLEGE

INDIVIDUAL RESEARCH BASED ESSAY

U. S. RELIANCE ON SOUTH AFRICA FOR STRATEGIC MINERALS: ITS IMPACT ON U. S. NATIONAL DEFENSE PRODUCTION

BY

LAURENCE R. MEDLIN
LIEUTENANT COLONEL, U.S.M.C.

15 APRIL 1982

Over the past 30 years, there has been a developing trend toward the internationalization of the United States economy. The nonavailability of nonfuel mineral resources has encouraged this trend and has become a matter of major concern to the U.S. which relies heavily upon foreign supplies for numerous nonfuel raw and processed minerals. In 1978 the value of nonfuel mineral imports was $21 billion; in 1979, $25 billion.[1] It is estimated that figure will rise to $29 billion for 1980. Net imports in the 1978-9 period provided 50 percent of apparent consumption for 20 of 40 major mineral commodities which have been described by the Department of the Interior, Bureau of Mines as most essential to our economy.[2]

In the past, the U. S. was proud to boast that she was basically a self-sufficient nation. There was a time when she produced more raw materials than she consumed. However, since 1950, the U. S. raw material situation has deteriorated drastically. Because of her dependence on foreign sources for critical raw materials (minerals) vital to her industries, the U. S. is becoming dangerously vulnerable to OPEC-style mineral cartels. For example, because of their dominant position as producers of cobalt, Zaire and Zambia have been able to manipulate the price of cobalt from $6.40 per pound in 1978 to around $25 per pound now.[3] Manipulation of this sort could result in disruption of supplies at a critical time--a time that might limit U. S. industrial or defense production when most needed.

The economic health and national security stability of a nation depends on access to minerals; and armament production relies on a healthy economy. U. S. national political goals, policies and social attitudes complicate the extent to which she relies on foreign mineral sources. In addition to natural shortages of some minerals, government actions have reduced the profitability of domestic investment to keep pace with her demands. Consequently the U. S. relies more and more on imported and processed materials. As her import dependence grows, U. S. reliance on potentially economically and politically unstable sources of supply increases.

These are the problems facing the U. S. as her dependence on foreign sources of critical raw materials emerges. The purpose of this paper is to examine U. S. dependence on South Africa as a supplier of strategic raw materials and the impact of this supply source on U. S. national defense production. The strategic raw materials examined will be limited to maganese, chromium, and platinum, three of the top 11 minerals which have been determined to be most critical to U. S. industrial production by the Department of the Interior. The paper will also examine alternate sources for the critical raw materials under study here and U. S. government inhibitors to domestic production of them. It must be stated at the outset that it is difficult to separate defense-related materials requirements from those of the civilian economy. A precise percentage has not been determined by the Department of the Interior. No federal agency, at this time, collects data in a form that can be used to show how much of any given mineral by percentage of total demand or consumption goes into national defense production as compared to that which goes into the civilian economy.[4] However, it can be

reasonably assumed that any significant shortage of a critical material would have a significant impact on defense-related applications of the material.

U. S. Import Dependency

That the United States is becoming increasingly dependent on foreign sources for certain strategic nonfuel raw and processed materials has already been noted. Before continuing, it is first necessary to define a few terms and concepts. A "strategic" material is one not found or produced domestically in sufficient quantities to meet minimum national economic and defense needs in times of contingencies that either seriously disrupt supplies or cause sharp price increases.[5] It is a "critical" material if it is essential to a desired production process. A nation is "vulnerable" to contingencies if there is a substantial threat to its economy or defense production capability if supply of strategic materials is disrupted. Vulnerability is a function not only of import reliance but also of political and economic stability of major suppliers, duration of supply disruptions, concentration of mining production in one or a few foreign countries, the cost of the potential loss to the nation's economy and the availability of alternatives to mitigate any adverse impacts.[6] Therefore, if import reliance is low, the nation obviously faces no substantial vulnerability to disruptive contingencies; however, as import reliance increases, the uncertainty of future price and availability increases. It follows then that "strategic" equates more with vulnerability than simply import reliance.

For the United States, import reliance on selected strategic materials, coupled with concentration of mine production in one or a few foreign countries, along with actual or potential political and economic instability of our major suppliers make availability of selected minerals a potential problem and increases vulnerability. As its dependence increases, the U. S. becomes more and more vulnerable to interruption in the supply of the materials and less secure in its capability to meet national economic and defense production needs. Table 1 reflects an array of critical raw materials on which the U. S. is import reliant in varying degrees, the top 11 being those materials that the Bureau of Mines holds as being especially important strategically.[7] Applying the criteria of vulnerability, it can be seen that the U. S. is vulnerable to imports of three especially important strategic and critical minerals from South Africa: manganese, chromium, and the platinum group. The strategic significance of these three critical minerals is further enhanced by a U. S. Bureau of Mines projection of U. S. import reliance for the year 2000: manganese 99%; chromium 100%; and platinum group 99%. South Africa has the world's largest known reserves of these minerals. A more thorough explanation of determining present and future U. S. vulnerability regarding these minerals will be developed later in the paper.

In some instances, U. S. importation of raw materials is done for economic reasons--it is cheaper to import vice producing locally; in other instances importing is required because of domestic nonexistence, critically short domestic reserves, or inadequate production. For whatever reason they are imported, their demand has increased competition in the world market for resources.

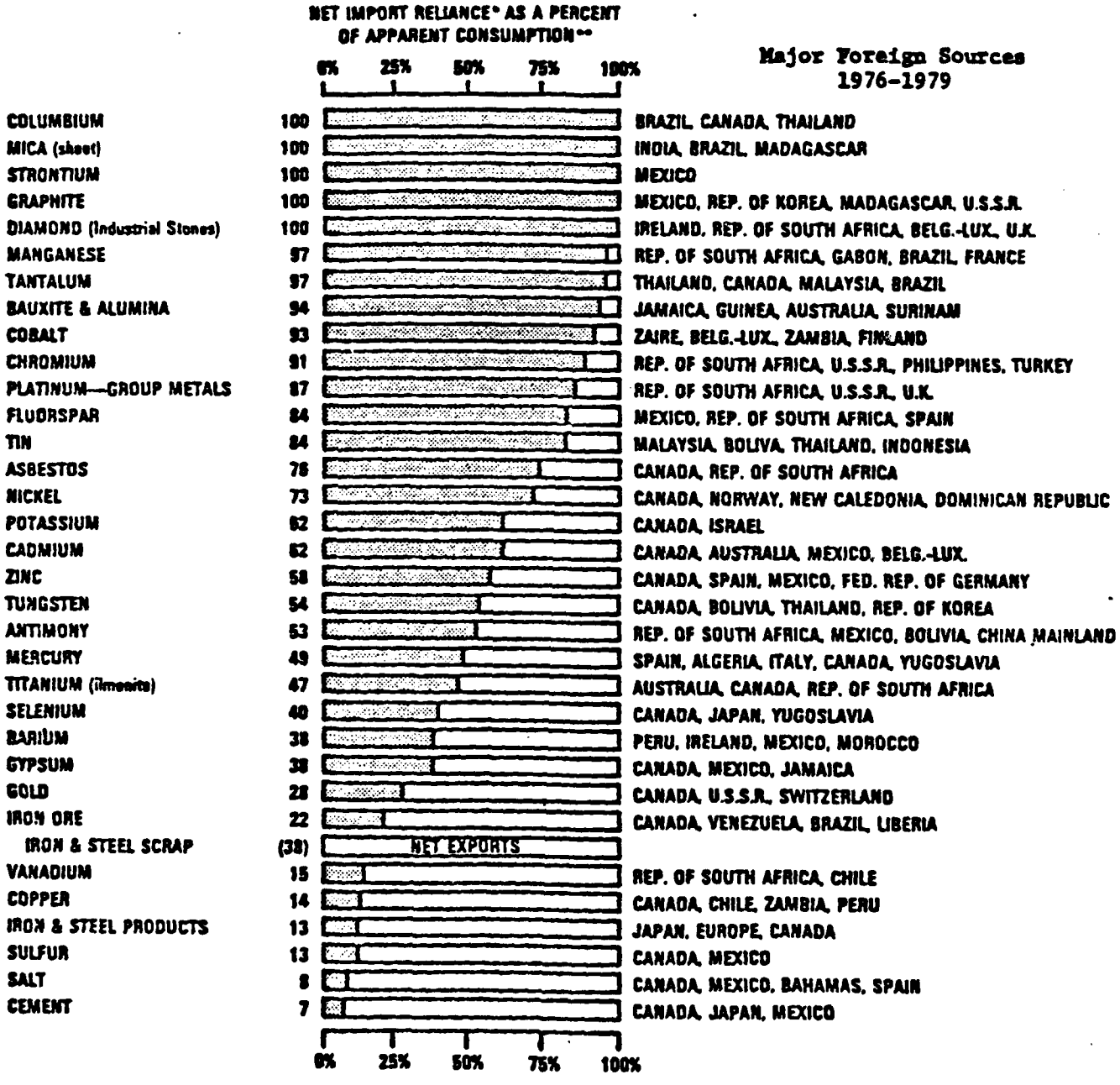

NET IMPORT RELIANCE* AS A PERCENT OF APPARENT CONSUMPTION**
0% 25% 50% 75% 100%
Major Foreign Sources 1976-1979
COLUMBIUM 100 BRAZIL, CANADA, THAILAND
MICA (sheet) 100 INDIA, BRAZIL, MADAGASCAR
STRONTIUM 100 MEXICO
GRAPHITE 100 MEXICO, REP. OF KOREA, MADAGASCAR, U.S.S.R.
DIAMOND (Industrial Stones) 100 IRELAND, REP. OF SOUTH AFRICA, BELG.-LUX., U.K.
MANGANESE 97 REP. OF SOUTH AFRICA, GABON, BRAZIL, FRANCE
TANTALUM 97 THAILAND, CANADA, MALAYSIA, BRAZIL
BAUXITE & ALUMINA 94 JAMAICA, GUINEA, AUSTRALIA, SURINAM
COBALT 93 ZAIRE, BELG.-LUX., ZAMBIA, FINLAND
CHROMIUM 91 REP. OF SOUTH AFRICA, U.S.S.R., PHILIPPINES, TURKEY
PLATINUM—GROUP METALS 87 REP. OF SOUTH AFRICA, U.S.S.R., U.K.
FLUORSPAR 84 MEXICO, REP. OF SOUTH AFRICA, SPAIN
TIN 84 MALAYSIA, BOLIVA, THAILAND, INDONESIA
ASBESTOS 78 CANADA, REP. OF SOUTH AFRICA
NICKEL 73 CANADA, NORWAY, NEW CALEDONIA, DOMINICAN REPUBLIC
POTASSIUM 62 CANADA, ISRAEL
CADMIUM 62 CANADA, AUSTRALIA, MEXICO, BELG.-LUX.
ZINC 58 CANADA, SPAIN, MEXICO, FED. REP. OF GERMANY
TUNGSTEN 54 CANADA, BOLIVIA, THAILAND, REP. OF KOREA
ANTIMONY 53 REP. OF SOUTH AFRICA, MEXICO, BOLIVIA, CHINA MAINLAND
MERCURY 49 SPAIN, ALGERIA, ITALY, CANADA, YUGOSLAVIA
TITANIUM (ilmenite) 47 AUSTRALIA, CANADA, REP. OF SOUTH AFRICA
SELENIUM 40 CANADA, JAPAN, YUGOSLAVIA
BARIUM 38 PERU, IRELAND, MEXICO, MOROCCO
GYPSUM 38 CANADA, MEXICO, JAMAICA
GOLD 28 CANADA, U.S.S.R., SWITZERLAND
IRON ORE 22 CANADA, VENEZUELA, BRAZIL, LIBERIA
IRON & STEEL SCRAP (38) NET EXPORTS
VANADIUM 15 REP. OF SOUTH AFRICA, CHILE
COPPER 14 CANADA, CHILE, ZAMBIA, PERU
IRON & STEEL PRODUCTS 13 JAPAN, EUROPE, CANADA
SULFUR 13 CANADA, MEXICO
SALT 8 CANADA, MEXICO, BAHAMAS, SPAIN
CEMENT 7 CANADA, JAPAN, MEXICO
0% 25% 50% 75% 100%

Table 1

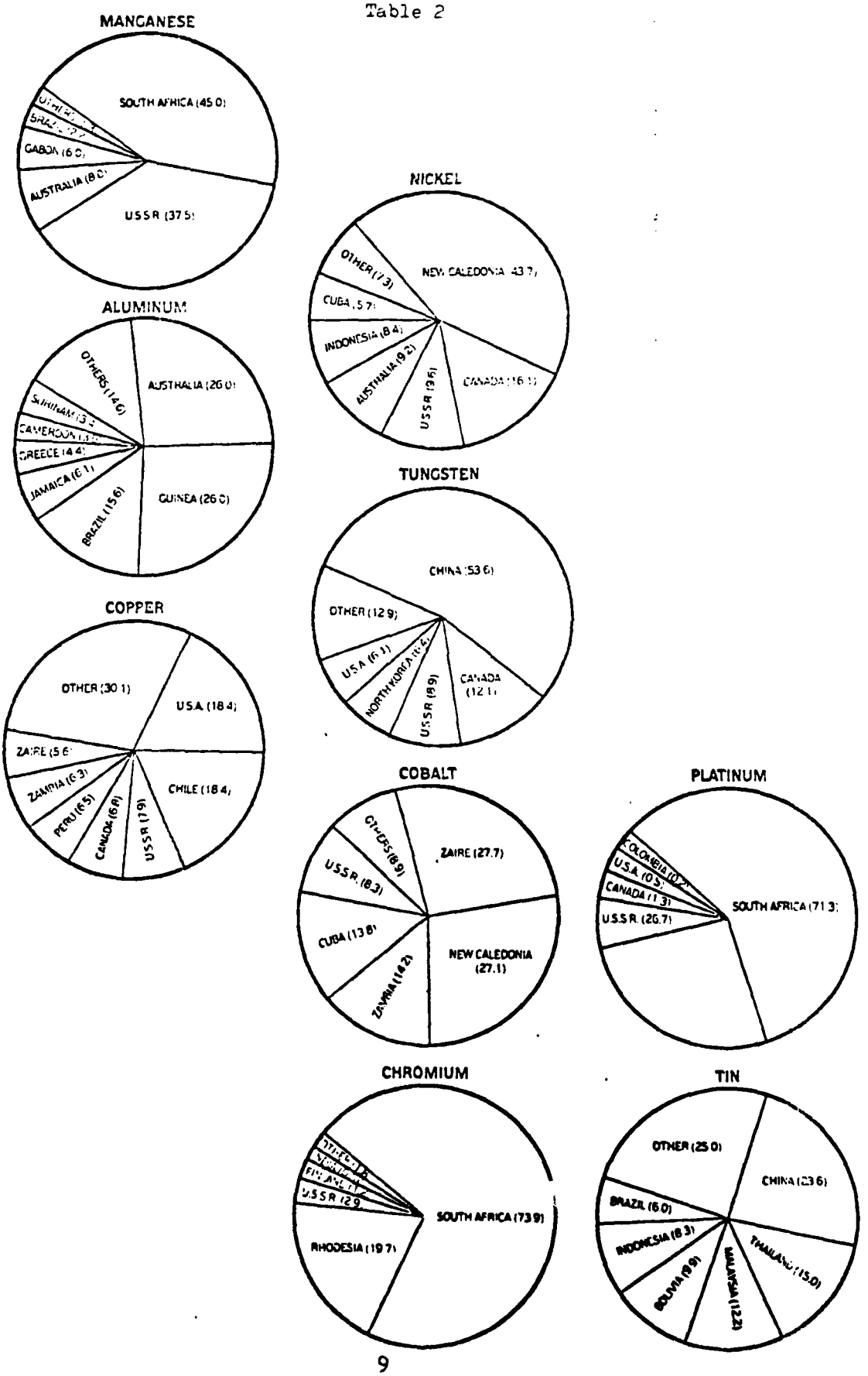
In this century, worldwide per capita consumption of mineral resources has risen by a factor of nine times. If the population growth continues at its present rate, world consumption at the end of the century will increase three times our present rate. In fact, the Bureau of Mines projects U. S. total nonfuel mineral imports to increase to $50 billion by the year 2000.[9] It is not the physical adequacy of minerals that is the major concern; it is the source and access to the source. The concentration of many of the world's critical materials in politically unstable countries and the increased politicization of mineral supplies are problems facing most western nations, especially the U. S.[10] From Table 2 it can be seen that three countries control over two-thirds of six of the key critical minerals: 90.5% of manganese, 96.5% of chromium, 99.7% of platinum, 74.6% of tungsten, 69.4% of nickel, and 69% of cobalt.[11] South Africa's known reserves as a percentage of world reserves are: manganese, 45%; chromium, 73.9%; platinum, 71.3%.

Historically U. S. import dependence on South Africa's minerals has been significant. In terms of total imports, in the period 1974 to 1977, the U. S. relied on South Africa for 9% of its manganese ore, 30% of its ferromanganese, 35% of its chromite, 38% of its ferrochromium, and 42% of its platinum group metals. Other major U. S. suppliers in that period were:[12]

Manganese ore--Brazil (37%), Gabon (31%), Australia (14%), other (9%);
Ferromanganese--France (38%), Japan (14%), other (18%);
Chromite--USSR (24%), Philippines (18%), Turkey (14%), other (9%);
Ferrochromium--Rhodesia (24%), Japan (16%), other (22%);
Platinum group--USSR (29%), UK (23%), other (6%).

This dependence has been increasing since 1977. For the period 1976-79 South Africa supplied: 9% manganese ore, 38% ferromanganese, 40% chromite, 62% ferrochromium, and 53% platinum group metals.[13]

Percentage Distribution of Mineral Reserves
Table 2



Impact of U. S. Import Reliance on South Africa

The following examination of manganese, chromium and platinum group metals reflects their strategic importance and U. S. vulnerability without access to an assured supply. These minerals have critical defense uses and are absolutely necessary for an industrialized economy. First, manganese. Apart from ocean manganese nodules, South Africa has the world's largest resources of manganese and is the world's second largest producer of manganese ore after the USSR.[14] It is a metal of vital importance to the steel industry, which accounts for 95% of all maganese consumed.[15] Manganese is an essential ingredient in the production of steel (for the removal of oxygen and sulfur) requiring 15 to 20 pounds per ton of steel produced. There is only limited substitution for manganese in the steel production process. Without manganese, the U. S. would have no significant steel production. Table 1 shows that the U. S. is 97% import dependent with much of the mineral being imported from South Africa. Though the U. S. has a limited amount of low-grade manganese ores, it does not yet have an economically viable process for extracting manganese from these ores. Since the USSR is the world's largest producer, South Africa, as a major U. S. source of supply, takes on increased significance.

The U. S. is 91% import dependent for chromium. Zimbabwe and South Africa combined have more than 94% of the world's supply. The Soviet Union also exports chromium to the U. S. In the production of stainless

steel, there is no adequate substitute for chromium. Chromium is also essential in the production of various corrosion and heat-resistant alloys. It is indispensable in the construction of conventional and nuclear power plants, the production of petrochemicals, gas turbines and oil refineries, and the entire stainless steel industry. There is no substitute for chromium-bearing stainless steel in applications such as gun barrels and jet engines that demand high strength and good corrosion resistance properties at high temperatures and pressures. In explaining the importance of chromium to the U. S. economy, a statement by the American Society for Metals revealed that "chromium-rich countries could, via embargo, political pressure, cartel formations, etc., seriously affect about 18% of the U. S. manufacturing sector."[16] The U.S. currently has no known reserves of chromium or manganese. Domestic mine production is thus not feasible without improvement in extraction and mining technologies which would be initiated only as a result of increased market prices.[17]

Platinum group metals are indispensable to industry because of their extraordinary physical and chemical properties. The USSR and South Africa control 98% of the world's supply with South Africa controlling more than 71%. The U. S. is 87% import dependent for this group of minerals. The metals are key to industrial processes principally because of their catalytic characteristics for controlling auto emissions and for their use in electrical components such as slip rings, commutators, thermocouples, and jet thrusters. They are also used extensively in the chemical and petroleum industries. There are no known substitutes.[18]

A closer look at the sources of supply in Table 1 for manganese,

chromium, and platinum reflects an alarming fact: for the most part, the supply of these critical mineral resources is dependent on the economic and political stability of several southern African nations on the one hand and our principal international rival on the other. U.S. current and potential dependence on imports from the Soviet Union and the several southern African countries creates an extremely unhealthy dilemma for U. S. national security. Access to and price of manganese, chromium and platinum are almost completely dependent on geopolitical events in the Soviet Union and southern Africa. Among other reasons, the adoption of Marxist regimes by five countries south of the Sahara and South Africa's firm adherence to her apartheid policy have contributed and continue to contribute to political instability in this region and raise the specter of the likelihood of supply disruptions.[19] Consequently, concern for the political stability of the area is vital to U.S. national interests. The price of a continuing, souring political situation could realistically result in an increased Soviet influence in the region, forming the basis for a Soviet influenced super-cartel of mineral resources.

In point of fact, the U. S. is waging a resources war with the Soviet Union. Whereas the U. S. is clearly import dependent on 11 critically important strategic materials, the Soviet Union is almost self-sufficient in the same resources. Our allies--Western Europe and Japan--are even more strategic-resource poor than the U. S. (Table 3).[20] The Soviet Union imports only five of some 40 strategic minerals she has determined a need for. Of the five minerals she does import, she is less than 50% import dependent in all but one.[21] The Soviet Union has for years attempted, and with some degree of success, to gain political and economic influence in the southern African nations, a part of her

Import Dependence of the European Community and Japan
Imports as a Percentage of Consumption

IMPORT	*E.E.C.*	*JAPAN*
ALUMINUM	61[b]	100[b]
CHROMIUM	100	100
COBALT	100[a]	
COPPER	81	90
IRON ORE	79	94
LEAD	53	76
MANGANESE	100	90
NICKEL	100[a]	100
PHOSPHATE	99	100
PLATINUM GROUP	100[a]	
TIN	87	97
TUNGSTEN	99	
URANIUM	59[c]	
VANADIUM	99	
ZINC	68	80

Consumption Includes Secondary Recovery.
[a]Excluding scrap.
[b]Allowing for imported bauxite, aluminum and metal.
[c]Proportion will rise rapidly as E.E.C. consumption grows and French production provides a smaller percentage.

Source:
Non-Fuel Minerals and Foreign Policy, Database, Philip Crowson, Economic Planning Department, The Rio Tinto Zinc Corporation Limited.

Table 3

resource war strategy. For example, there are currently more than 2,000 Cuban troops occupying Angola which borders on Zaire and Zambia; both countries are major producers of cobalt, of which the U. S. is 93% import dependent (Table 1).

The Politburo has set a course for control of strategic raw materials as a way to stymie the West. In a statement to the President of Somalia, Soviet Premier Leonid Breshnev boasted: "Our aim is to gain control of the two great treasure houses on which the West depends: the energy treasure house of the Persian Gulf and the mineral treasure house of Central and Southern Africa."[22] This threat has caused consternation from foreign investors for fear that African enterprises might be eventually nationalized; therefore, foreign investment in new mining ventures is on the decline which will eventually lead to a fall in the world's supply of critical mineral resources as present resources are depleted. The foregoing clearly indicates a strong U. S. national security interest in ensuring the political stability of South Africa. The lack of her critical minerals would have an obviously dramatic long term effect on U. S. national defense by curtailing national defense production capability.

The specter of a "resource war" has caused some Reagan administration aids to rethink ties to South Africa with an eye toward advancing those ties.[23] The outbreak of large scale civil unrest or civil war could result in a longtime disruption of her mineral exports which is a situation the administration does not want to deal with. In October 1980, Reagan formed a 23-person Strategic Minerals Task Force composed mostly of business and mining company officials to investigate the broad implications of mineral resource dependence, especially dependence on unstable sources. The Force has not yet reported formally

though there have been unofficial reports of members calling for a strengthening of ties between the U. S. and South Africa.[24] There are indications that the administration is taking a softer line in its dealings with South Africa.

It is vitally important to recognize that South Africa is a treasure house of strategic minerals and that it is in the U. S. national interest to ensure access to them. There is a need for public concern about strategic minerals and a need for recognition that the U.S. economy and national security are closely tied to mineral-rich South Africa. It is in the national interest of the U. S. to take positive political steps to improve the stability of southern Africa in general and South Africa in particular.

According to Congressman James D. Santini, Chairman of the House Subcommittee on Mines and Mining, "a supply disruption (of manganese, chromium and platinum) would pose serious economic, defense, and social consequences for the United States and its allies."[25] Paul K. Kruger, acting assistant director of the Resource Preparedness Office in the Federal Emergency Management Agency, has also emphasized the impact South Africa has on U. S. national security: "If somebody wanted to destabilize the Western economy, messing up South Africa is one way of doing it."[26] Further, President Reagan, in an interview by Walter Cronkite on March 3, 1981, singled out South Africa as "a country that strategically is essential to the Free World. It has the production of minerals we all must have . . . ."[27] This statement was made to emphasize a weak link in U. S. defense capability.

There is little doubt that South Africa, as a major U. S. supplier of manganese, chromium, and platinum group metals, and as the largest repository of the world's known reserves of these minerals, is

economically and militarily vital to the industrial and defense production capabilities of the U. S. and many of her allies. If these supplies were interrupted or denied in one way or another, then U. S. dependency would turn into vulnerability.

Alternate Sources of Critical Minerals

What are the alternatives to importation of strategic minerals if they are not available from South Africa or sufficiently available from alternate supplies? Some suggested methods for reducing increasing U. S. reliance on imports are development of substitutes, improved technology to facilitate economic extraction of minerals from submarginal domestic deposits, stockpiling, laws to stimulate domestic mineral exploration, tax incentives to promote domestic exploration, conservation and recycling, and ocean mining.[28] However, these considerations are very much complicated by the need to consider economic, social, political, environmental, and technological factors along with national security needs. Also, the availability and applicability of many of these alternatives is uncertain due primarily to the lead time associated with their implementation.

In the case of chromium and platinum from South Africa, since there are no substitutes known to exist at this time for many of their applications some means must be sought to secure access to these minerals in order to protect our national security interests. Regional conflicts that result in a cutoff of valuable and irreplaceable minerals must be considered and planned for. The 1973 Arab-Israeli War clearly demonstrated this possibility.[29] A nation in the midst of conflict cannot also be vulnerable to interruption or shortfalls of critical minerals; therefore, alternatives must be explored.

In an emergency situation, voluntary conservation in the form of reduced consumption for nonessential uses could help mitigate any supply disruption or sharp price increase in the short-term and provide additional time to implement alternative mitigating measures. For example, platinum for jewelry, and chromium for flatware, sinks, trim, etc., could be drastically curtailed.

Mineral substitution could also enhance conservation by making more critical materials available for uses for which there are no current substitutes. For example, many applications for stainless steel could use aluminum (for flatware, trim, etc.), freeing chromium for the more essential uses of stainless steel. Nickel could be substituted for manganese in alloy steels, and titanium for platinum in catalytic applications, thus freeing manganese and platinum for such applications where adjustments in performance and specification ranges cannot be lessened.

Accelerated recycling is yet another short-term conservation method if recycling facilities exist. If facilities do not exist, recycling becomes long term. The Bureau of Mines estimates that recycling of scrap steel and spent converter catalysts could result in a 23% return of chromium and 25% return of platinum group metals.[30]

More long-term fixes in the way of laws and tax incentives to stimulate domestic (and foreign) exploration and subsequent production could help mitigate future adverse impact in the event of supply disruption. These will be covered in more detail later.

Another possible long-term source of manganese is mining the ocean floor for manganese nodules. It is estimated that up to 100,000 tons of nodules per square mile are scattered over vast areas of the ocean floor

12,000-25,000 feet below the surface of the ocean. An international agreement has yet to negotiate who has the rights to mine the nodules and how the wealth is to be shared. Since 1974, 160 nations have been trying to hammer out the Law of the Sea treaty to govern exploitation of the resources.[31] Should agreement be reached, as hoped for next year, mining of the ocean floor could be in full swing by the year 2000.

Current access is of utmost importance to ensure national security. Strategic stockpiling is one short-term solution, and one of the more useful and readily available means for limiting U. S. import dependence and vulnerability. The first stockpiling act, The Strategic Materials Act, was passed in 1939 and was followed in 1946 by the Strategic and Critical Materials Stockpile Act. These acts provided for a stock of strategic and critical materials to be held to decrease dependence upon foreign sources of supply in times of wars or national emergencies by ensuring an adequate supply of certain natural resources for industrial and military requirements.[32] The stockpile, as originally planned for, was to be used solely for defense purposes; however, in 1976 President Ford modified its use to include civilian needs as well, though these needs were to be estimated separately from defense needs. Since 1946 there have been frequent and severe shifts in stockpile objectives having little to do with defense. The consequences of sales to control prices or to control inflation, and sales to balance the national budget have severely hindered the system and reduced its credibility for use in times of national emergency.

The responsibility for maintenance of the stockpile currently resides in the Federal Emergency Management Agency (FEMA), but the General Services Agency retains responsibility for stock purchases,

sales, and rotation.[33] The Department of Defense is not directly involved in the process even though it has the most direct interest. FEMA has the requirement under the 1946 Act to maintain the stockpile inventory of 93 selected materials sufficient to cover U. S. needs for not less than three years for a national emergency.[34] Approximately 60% of the materials stockpiled do not meet established goals. Of the three strategic minerals under discussion from South Africa, only the platinum stockpile is equal to the three year supply requirement; manganese and chromium stockpiles are somewhat less than the three year goal.[35] To remedy the shortfall, the administration has included stockpile replenishment funds in its budgets for the last three years; however, Congress has not appropriated funds to meet the requests. The last major stockpile purchase was made in 1960.[36] The technical and qualitative absolescence of some stockpiled materials limits their use in many of today's sophisticated applications; for example, there is only one remaining facility in the U. S. that processes stockpiled manganese ore into its useable ferromanganese alloy form.

Stockpiling of critical materials represents more than just assurance of adequate supplies in times of national emergency. It represents huge swings in lead times, production capacity, scarce machinery, manpower, energy, and transportation incident to mining and processing these minerals. An adequate stockpile would eliminate short-term demands that would otherwise create additional constraints during an emergency. At the present time, however, the U. S. is not prepared to accept a drastic supply shortfall of manganese and chromium from South Africa.

These and other measures indicate a number of alternatives to

lessen the adverse impact of supply disruption of strategic raw materials from South Africa, or a sudden price increase of these minerals. Unfortunately all alternatives are not available to the U. S. for certain of the minerals. For example, domestic mine production without improvements in extraction and mining technology is not possible in the case of manganese and chromium because there are no known U. S. reserves of these two minerals; and there is less than one million tons of the platinum group metals in U.S. reserves.[37]

U. S. Government Inhibitors to Domestic Production

As changes in government regulations and policies for the past 10 years have multiplied, so has the cost of domestic mining and processing of minerals increased dramatically. The U. S. government has tended to do more to discourage and less to stimulate investment in domestic mineral projects by:[38]

Restricting the use of federal lands for mineral exploration while some foreign suppliers sponsor such efforts;

Imposing strict environmental requirements while foreign suppliers are either more lenient or help in defraying costs;

Restricting joint ventures to pool resources while foreign suppliers encourage joint ventures and sometimes participate in financing projects;

Adding to labor costs by establishing worker health and safety requirements while foreign suppliers are more lenient or help in defraying costs.

Furthermore, the decline in both mining and mineral processing activity has resulted in lost jobs in the industry, unfavorable balance of trade, and increased concern over the vulnerability of the U. S. to interruption of material supplies.[39]

The U. S. could reduce import reliance substantially by rewriting and modifying existing laws and regulations that prohibit mining of minerals or make it prohibitively expensive. Many of the mineralized

areas of the United States are contained in the 750 million acres of public lands. These lands have tremendous mineral potential but many have never been explored. In 1979, three-fourths of these lands were either closed or severely restricted to hard-rock mineral mining activity because of legal constraints. Some of the federal restrictions on mineral exploration include: Clean Air Act, Federal Water Pollution Control Act, Wilderness Act, Federal Land Policy and Management Act, and the Surface Mining Control and Reclamation Act. Further, there are more than 80 different laws administered by 20 different federal agencies which directly or indirectly affect the domestic nonfuel minerals industry.[40] Regulatory processes that are lengthy and complex, federal government demands for data, environmental, safety, and health requirements often discourage and prevent companies from starting new ventures or expanding existing ones. In summary, current national laws and tax incentives restrict access to and use of federal lands; they also discourage new or expanded mining operations which are necessary for long-term planning to assure available mineral supplies for defense production and the national economy. Considering the 5 to 10 year start-up time that is required to develop facilities and produce a mineral once it has been discovered, the impact on U. S. national economy and defense production capability could be disastrous if her major import supplies were cut-off or mineral prices jumped sharply.

Summary

Clearly the U. S. is currently import reliant on South Africa for long-term supply of manganese, chromium, and the platinum group metals which are absolutely essential for U. S. industrial production in the civilian economy and for defense production needs. The use of properly stockpiled quantities of these minerals and a combination of conservation, substitution, and recycling would meet our needs in the short term should a disruption in imports occur. Long-term independence, however, is dependent upon revision of U. S. federal regulations and tax incentive programs to allow for domestic exploration, encourage investment for technological advances and breakthroughs. Generally, rich overseas mineral deposits and cheap foreign labor combined with our federal regulations and tax disincentives have decreased domestic incentives for production. The U.S. must keep abreast of developments in its minerals industry, stay attuned to costs associated with actions detrimental to the industry and keep to a minimum the effects of policy and regulation conflicts that affect the industry. Another long-term fix that would reduce U. S. reliance on South Africa is increasing the number of suppliers by promoting political and economic stability in southern Africa. The supply base would be expanded, making the U. S. less vulnerable to supply disruptions or sharp price increases.

Finally, U. S. vulnerability can be reduced by influencing the

degree of political and economic stability of South Africa. Economic necessity in the access and production of strategic raw materials may force a change in current policy toward South Africa that would have a stabilizing effect. As sources of critical raw materials are depleted, the industrialized nations of the world will compete more strongly for the remaining supplies; therefore, the potential for increased political instability in southern Africa is likely, especially if competing nations align themselves with South Africa at the expense of the other independent African nations. The ultimate price for access to all of Africa's minerals riches is support of African political, social, and economic goals. However, South Africa's mineral treasure house is too important to be ignored; therefore, the U. S. must work with all of Africa to seek a solution to the minority rule problem in South Africa. The U. S. must develop a foreign policy directed towards achieving fundamental change in South Africa--for U. S. self-interest as well as the interests of all of Africa.

Endnotes

1. U. S. Bureau of Mines. Status of Mineral Industries (Washington, D. C.: Bureau of Mines, October 1979), p. 35.

2. Ibid., p. 37.

3. U. S. Congress. House Committee on Armed Services, Industrial Preparedness Panel. The Air Force Systems Command Statement on Defense Industrial Base Issues (Washington, D. C.: USGPO, November 1980), p. III-9.

4. U. S. General Accounting Office. Minerals Critical to Developing Future Energy Technologies, Their Availability and Projected Demand (Washington, D. C.: GAO, June 1981), p. 1.

5. Hankee, William B. and King, A. H. The Role of Security Assistance in Maintaining Access to Strategic Resources (Carlisle, Pa.: Strategic Studies Institute, USAWC, September 1978), p. 7.

6. USGAO. Minerals Critical, p. 16.

7. U. S. Bureau of Mines. The Role of Strategic Materials and Energy in the U. S. Economy and National Security (Washington, D. C.: Bureau of Mines, June 1981), p. 8.

8. USGAO. Minerals Critical, p. 19.

9. U. S. Congress. House. U. S. Mining and Processing Industry: An Analysis of Trends and Implications (Washington, D. C.: Comptroller General, October 1979), p. 62.

10. Jordan, Amos A. and Kilmarx, Robert A. "Strategic Mineral Dependence: The Stockpile Dilemma." The Washington Papers (Beverly Hills: Sage Publications, 1979), pp. 11-13

11. Bureau of Mines. The Role of Strategic Materials, pp. 21-22.

12. Broad, William J. "Resources Wars: The Lure of South Africa." Science, 210, Dec. 5, 1980, p. 1100.

13. U.S. Bureau of Mines. Mineral Commodity Summaries 1981 (Washington, D.C.: Bureau of Mines, January 1981), pp. 32-115.

14. USGAO. Minerals Critical, p. 17.

15. van Rensburg, W. C. J. and Pretorius, D. A. South Africa's Strategic Minerals: Pieces on a Continental Chessboard (Johannesburg: Colorpress, 1977), p. 55.

16. Hankee and King, p. 12.

17. USGAO. Minerals Critical, p. 5.

18. van Rensburg and Pretroius, p. 52.

19. U. S. Congress. Committee Preparedness Panel, p. III-6.

20. Kilmarx, Robert A. and Haendel, Dan. "The U. S. Strategic Minerals Stockpile: Remedy for Increasing Vulnerability?" Comparative Strategy (New York: Crane, Russak & Company, 1979), p. 311.

21. U. S. Congress. Committee Preparedness Panel, p. III-4.

22. Kunert, Dirk T. South Africa: Supermarket of the World's Minerals (Johannesburg: Southern African Forum, September 1981), p. 5.

23. Broad, p. 1099.

24. Ibid., p. 1099.

25. Kunert, p. 4.

26. Ibid., p. 6.

27. Ibid., p. 6.

28. USGAO, Minerals Critical, p. 4.

29. Jordan and Kilmarx, p. 9.

30. USGAO. Minerals Critical, p. 29.

31. Sheils, Merrill. "Mining the Ocean Bottom." Newsweek, Nov. 10, 1980, p. 97.

32. Kilmarx and Haendel, p. 314.

33. Ibid., p. 315.

34. Federal Emergency Management Agency. Stockpile Report to Congress (Washington, D. C.: FEMA, January 1981), p. 2.

35. Ibid., p. 19.

36. U. S. Congress. Committee Preparedness Panel, p. III-14.

37. U. S. Bureau of Mines. Mineral Facts and Problems (Washington D. C.: Bureau of Mines, 1975), p. 32.

38. U. S. Congress. House. Mining and Processing, p. 74.

39. Ibid,. p. 74.

40. U. S. Congress. Committee Preparedness Panel, p. III-11.

Bibliography

Broad, William J. "Resources Wars: The Lure of South Africa." Science, 210, Dec. 5, 1980, 1099-1100.

Carter, Gwendolen M. Which Way Is South Africa Going? Bloomington: Indiana University Press, 1980.

Clifford-Vaughan, F. M. International Pressures and Political Change in South Africa. Cape Town: Oxford University Press, 1978.

Dostert, P. E. Africa 1980. Washington, D. C.: Stryker-Post Publications, Inc., 1980.

Duignan, Peter. "A Case for Detente with South Africa." AEI FOREIGN POLICY AND DEFENSE REVIEW, I, No. 1, (1979), 16-17.

Federal Emergency Management Agency. Stockpile Report to the Congress. Washington, D. C.: FEMA, January 1981.

Good, Robert C. "Seven Guidelines for U. S. Policy Toward South Africa." AEI Foreign Policy and Defense Review, I, No. 1 (1979), 57-59.

Hankee, William B., and King, A. H. The Role of Security Assistance in Maintaining Access to Strategic Resources. Carlisle, Pa.: Strategic Studies Institute, USAWC, September 1978.

Jordan, Amos A., and Kilmarx, Robert A. "Strategic Mineral Dependence: The Stockpile Dilemma." The Washington Papers. Beverly Hills: Sage Publications, 1979.

Kilmarx, Robert A., and Haendel, Dan. "The U. S. Strategic Minerals Stockpile: Remedy for Increasing Vulnerability?" Comparative Strategy. New York: Crane, Russak and Company, 1979.

Kunert, Dirt T. South Africa: Supermarket of the World's Minerals. Johannesburg: Southern African Forum, September 1981.

Malenbaum, Wilfred. World Demand for Raw Materials in 1985-2000. New York: McGraw-Hill, Inc., 1978.

Seifer, John. "Which Way in Southern Africa?" Africa Report, May-June 1981, 17-22.

Sheils, Merrill. "Mining the Ocean Bottom." Newsweek. Nov. 10, 1980, 97-98.

Simon, Julian L. "The Scarcity of Raw Materials." The Atlantic Monthly. June 1981. 33-41.

Spence, J. E. The Strategic Significance of Southern Africa. Whitehall, London: Royal United Service Institution, October 1970.

State of South Africa: Economic, Financial and Statistical Year-Book for the Republic of South Africa. Johannesburg: Da Gama Publishers, 1978.

"Strategic Stockpiles: Who's Hoarding What?" The Economist. May 24, 1980, 87-88.

Szuprowicz, B. O. How to Avoid Strategic Materials Shortages. New York: John Wiley and Sons, Inc., 1981.

U. S. Bureau of Mines. Mineral Facts and Problems. Washington, D. C.: Bureau of Mines, 1975.

_____. Mineral Commodity Summaries 1981. Washington, D.C.: Bureau of Mines, 1981.

_____. The Role of Strategic Materials and Energy in the U. S. Economy and National Security. Washington, D. C.: Bureau of Mines, June 1981.

_____. Status of the Mineral Industries. Washington, D. C.: Bureau of Mines, October 1979.

U. S. Congress. House. U. S. Mining and Processing Industry: An Analysis of Trends and Implications. Washington, D. C.: Comptroller General, October 1979.

_____. Committee on Armed Services, Industrial Preparedness Panel. The Air Force Systems Command Statement on Defense Industrial Base Issues. Washington, D. C.: USGPO, November 1980.

U. S. General Accounting Office. Minerals Critical to Developing Future Energy Technologies, Their Availability and Projected Demand. Washington, D. C.: GAO, June 1981.

van Rensburg, W. C. J. South Africa 1980-81: Official Yearbook of the Republic of South Africa. Johannesburg: van Resnburg Publications, 1981.

van Rensburg, W. C. J., and Pretorius, D. A. South Africa's Strategic Minerals: Pieces on a Continental Chessboard. Johannesburg: Colorpress, 1977.